Mascoma River Watershed

New Hampshire

Key:

- Watershed Boundaries
- Contour Lines (20 meter)
- Municipal Boundaries
- Utility Lines
- Lebanon Airport
- Rail Lines

Roads

- Interstate
- Secondary Highway
- Local
- Not Maintained / Discontinued

- Streams
- Lakes and Ponds
- Wetlands (NWI)

Conservation and Public Lands

- Municipal / County
- Federal
- State
- Other Public / Quasi Public
- Private

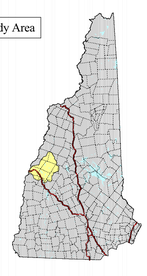
Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

N

Study Area



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Conserved Land within the Mascoma Watershed

Municipality	% Conserved	Acres Conserved	Total Acres
Grafton	34.3	1812.2	5281.4
Orange	23.4	1617.7	6907.1
Dorchester	18.4	2679.0	14588.4
Hanover	18.2	1744.6	9591.3
Enfield	16.3	4127.9	25379.4
Grantham	11.3	43.4	384.1
Lebanon	6.5	1153.1	17777.6
Canaan	5.9	2069.3	35030.5
Lyme	3.8	222.3	5878.4
Plainfield	2.8	102.3	3702.3
Springfield			76.9

Conservation Lands

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Mascoma Watershed Conservation Council
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- Conservation and Public Lands
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- Lakes and Ponds
- Wetlands (NWI)

Landcover
- Developed
- Agricultural Fields / Pasture
- Cleared Lands (old fields, clearcuts, etc.)
- Orchards
- Deciduous Forest
- Mixed Forest
- Coniferous Forest
- Open Water
- Forested Wetland
- Open Wetland
- Disturbed (gravel pits, quarries, etc.)
- Exposed Bedrock

Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

N

Study Area

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Land Cover Data:

Land cover data from the New Hampshire Land Cover Assessment - 2001, provided by GRANIT.

The New Hampshire Land Cover Assessment categorizes land cover and land use into 23 classes, based largely on the classification of Landsat Thematic Mapper (TM) imagery acquired between 1990 to 1999. The goal of the New Hampshire Land Cover Assessment is to provide a multi-purpose data set to support regional analysis. Particular emphasis is placed on delivering as much detail as possible in the forested and agricultural classes. The codes in parentheses and class definitions below refer to GRANIT's classification scheme

Developed - from class "Developed" (100), defined as built-up areas.
Agricultural Fields / Pasture - includes classes "Row crops" (211) and "Hay/rotation/permanent pasture" (212). The "Active agriculture" group (200-299) are defined as hay fields, row crops, plowed fields, etc.
Orchards - from class "Fruit Orchards" (211), while also part of the "Active Agriculture" group, this class is kept separate as orchards have wildlife habitat properties distinct from agricultural fields.
Cleared Lands - from class "Cleared/other open" (790), defined as clear cut forest, old agricultural fields are reverting to forest, etc.
Deciduous Forest - includes all deciduous forested classes (410 - 419), defined as forested stands comprising less than 25% coniferous basal area per acre.
Mixed Forests - from class "Mixed stands" (430), defined as forested stands comprising greater than 25% and less than 65% coniferous basal area per acre.
Coniferous Forests - include all coniferous forested classes (420-429), defined as forested stands comprising greater than 65% coniferous basal area per acre.
Open Water - from class "Water" (500), defined as lakes, ponds, some rivers or any other open water feature.
Forested Wetlands - from class "Forested Wetlands" (610). The "Wetlands" group (600-699) is defined as areas dominated by wetland characteristics defined by the U. S. Fish and Wildlife Service National Wetlands Inventory. Basically hydric soils, hydrophytic vegetation and the hydrologic conditions that result in water at or near the surface for extended periods of the growing season.
Open Wetlands - from class "Non-Forested Wetlands" (620). Also part of the "Wetlands" group (600-699; see Forested Wetlands above).
Disturbed - from class "Disturbed" (710), defined as gravel pits, quarries or other areas where the earth and vegetation have been altered or exposed.
Exposed Bedrock - from class "Bedrock / Vegetated" (720), defined as exposed bedrock or ledge (usually in the mountains) that may have some forms of stunted vegetation growing in cracks or lichens growing on the surface rock.

Note that "Transportation" (140) is not shown here as the Roads datalayer show that class more accurately.

Landcover

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Unfragmented Lands (by acreage)

- 500 - 1000
- 1000 - 5,000
- 5,000 - 10,000
- 10,000 - 25,000
- > 25,000

Note: Unfragmented blocks are labelled by name and acreage in red on the map.

Unfragmented Lands Acreage (> 1000 acres)

Name	Total	Watershed	% Conserved Total	% Conserved Watershed
Mascoma River Headwaters	59287	22296	11.4	11.7
Mount Cardigan	33417	5524	19.8	28.1
Snow Mountain	18130	3441	7.0	0.0
Smith Pond	8205	6056	53.8	50.6
Moose Mountain	7693	4430	32.2	33.4
Grafton Pond	4888	2683	40.5	66.0
Marshall Brook	4414	2047	20.8	3.3
Great Brook	3887	1374	16.4	7.4
Prescott Hill	3475	1214	10.6	24.8
Goose Pond West	3461	3461	3.5	3.5
Boston Lot Lake	3150	1330	16.8	0.2
Lovejoy Brook	2911	2911	2.1	2.1
Mirror Lake	2464	737	15.8	1.1
Bear Pond	2461	2461	49.6	49.6
McDaniels Marsh	2201	116	36.1	16.9
Half Moon	2116	87	0.0	0.0
Methodist Hill	2101	2101	0.0	0.0
Apple	1917	116	1.7	2.2
Mud Pond	1453	1453	12.4	12.4
George Pond	1380	1340	0.5	0.5
Mount Tug	1370	1270	5.0	1.3
Canaan Lake	1362	1362	3.2	3.2
Signal Hill	1270	1182	3.6	3.8
Indian River	1251	1251	0.0	0.0
Gulf Brook	1245	1245	0.0	0.0
Farnum	1225	628	58.1	46.3
Goodwin	1160	1153	30.9	31.1
Height of Land	1106	808	0.0	0.0
Hoyt Brook	1099	1099	0.0	0.0
Rix Ledge	1008	275	3.9	5.3

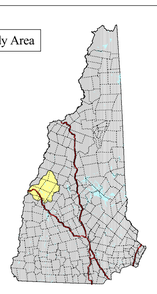
Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

N

Study Area



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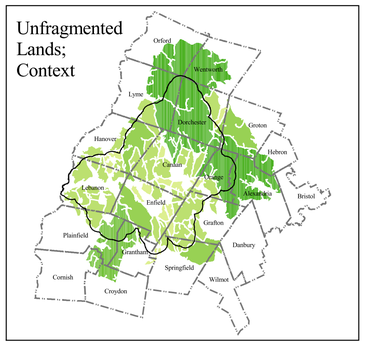
Unfragmented Lands:

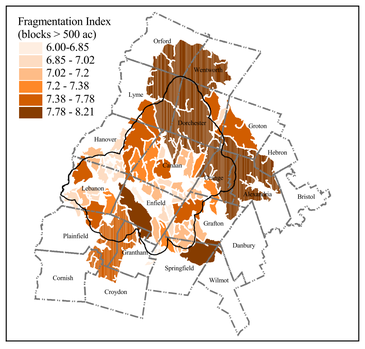
-Unfragmented lands were developed by applying a 500 foot buffer to a composite roads layer, erasing it from the study area and surrounding land mass, and then classifying the resulting unfragmented blocks according to acreage. The composite roads layer was formed by merging USGS roads and NH DOT roads. All road classes were buffered except for class 6 roads.
-The fragmentation index (lower right) describes the degree of fragmentation through a ratio of perimeter length to acreage (natural logarithm of area:perimeter)

Unfragmented Lands; Context



Fragmentation Index (blocks > 500 ac)

- 6.00-6.85
- 6.85 - 7.02
- 7.02 - 7.2
- 7.2 - 7.38
- 7.38 - 7.78
- 7.78 - 8.21



Unfragmented Lands

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Important Soils

- Prime Farmland Soils
- Farmland Soils of Statewide Importance
- Hydric Soils
- Important Forest Soils (IC)
- Important Forest Soils (IA, IB)

Note: Soils data layers are "stacked" in the order shown above.
Some portions of the lower layers may be partially obscured.
See notes at lower right.

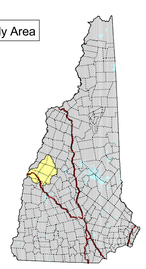
Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

N

Study Area



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Soil Data:

Soil Data derived from the Natural Resources Conservation Service Soils Data provided by GRANIT.

-Hydric Soils
"A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." As a result of soil saturation and reducing conditions, hydric soils undergo chemical reactions and physical processes which differ from those found in upland soils. Hydric soils are one of the three diagnostic environmental characteristics used in the identification of wetlands, with the other two characteristics being a prevalence of wetland vegetation and the presence of wetland hydrology.

-Farmland of Statewide Importance
These are lands that are not prime or unique but are considered farmlands of statewide importance for the production of food, feed, fiber, forage and oilseed crops.

-Prime Farmland Soils
The Natural Resource Conservation Service (NRCS) defines prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. It may be pasture, cultivated land, forest land or other lands except for those that represent urban, built-up, or water areas. Prime farmland soils produce the highest yields with the least expenditure of time and energy. Farming them results in the least environmental damage.

-Productive Forest Soils.
The NRCS productive forest soil groups indicate the relative productivity of lands for timber production. The top three categories are: IA, IB, and IC. IA consists of the deeper, loamy textured, moderately well, and well-drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships and are best suited to hardwoods. The successional trends on these soils are toward stands of shade tolerant hardwoods such as beech and sugar maple. Hardwood competition is severe on these soils so softwood regeneration is usually dependent upon persistent hardwood control efforts.

IB soils are generally sandy or loamy soils over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained and are primarily suited to hardwoods. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Hardwood competition is moderate to severe on these soils and successional softwood regeneration is dependent upon hardwood control. IC soils are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. Successional trends on these coarse textured, somewhat droughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., red spruce and hemlock. Balsam fir is a persistent component in many stands, but is shorter lived than red spruce and hemlock. White pine, red maple, aspen, and paper birch are common in early and mid-successional stands. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production, especially white pine.

Overlap between Soil Classes -
In this study area there is no overlap between hydric soils (HYDRIC = "yes") and important agricultural soils (FARMCLASS = "all areas are prime farmland" or FARMCLASS = "farmland of statewide importance"), nor is there overlap between the two agricultural soil classes. Since these soil classes are mutually exclusive, they are displayed in solid colors for clarity's sake. There is overlap between the larger important forest soils group (FORSOILGRP = "IA" or "IB" or "IC") and the other soil classes; this soil group serves as a "backdrop" to the others. For reference, there is no overlap between hydric soils and important forest soils, class 1C (FORSOILGRP = "IC"). Also, all prime farmland soils (FARMCLASS = "all areas are prime farmland") are also important forest soils, class 1A only (FORSOILGRP = "IA"). And, all farmland soils of statewide importance are either 1A or 1C important forest soils only.

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Note: Point features on this map may be displayed at differing sizes. This is to increase visibility in less dense areas, and to decrease overlap in more dense areas

- Lebanon Snow Dump (MWCC Identified)
- Underground Storage Tanks
- Junkyards
- Public Water Supply
- Sanitary Radii
- Wellhead Protection Areas

Contamination Sites
- Known
- Potential

Threats to Source Water Quality
- Known
- Potential

Potential Sources of Point Pollution
- Combined Sewer Outfall
- Septage/Sludge
- Mine
- Sand/Salt Storage

Aquifers
- Transmissivity >= 500 ft2/day
- Potentially Favorable Gravel Well Areas

Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

N

LYME
DORCHESTER
HANOVER
CANAAN
GROTON
ORANGE
ALEXANDRIA
LEBANON
ENFIELD
PLAINFIELD
GRANTHAM
GRAFTON
SPRINGFIELD

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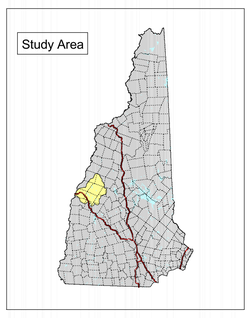

Water Resources

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Water Resources:

-"Potential Sources of Point Pollution", "Known Contamination Sites", "Junkyards, and "Threats to Ground Water Quality" were provided by the New Hampshire Division of Environmental Services
-Potentially Favorable Gravel Well Areas were derived by removing areas with potential for groundwater contamination (NH DES derived "U400" layer) from high transmissivity aquifers (Aquifers, T-Max ³ 2000 sq. ft / day).
-Sanitary Radii were derived by buffering the Public Water Supply Layer on the sanitary radius field. The size of the sanitary radius is determined by the permitted daily production of the well (gallons / day):

<14,401	150'
14,401 - 28,800	175'
28,801 - 57,600	200'
57,601 - 86,400	250'
86,401 - 115,200	300'
115,201 - 144,000	350'
> 144,000	400'

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- Gravel Pits
- Deer Yards
- Open Lands

Wetlands (NWI)
- Emergent
- Non-emergent

Undeveloped Shorelines
- 0-150'
- 150-300'

Slope
- Steep (>35%)
- South Facing (>10%)

Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

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Wildlife Habitat Data:
- Gravel Pits were derived from the NH Department of Environmental Services "Point/Non-Point Pollution Sources" data layer; used categories "mine: hardrock quarry" and "mine: sand and gravel".
- Deer Yards were digitized by the Upper Valley Lake Sunapee Regional Planning Commission from "Deer Wintering Area Mapping Project" paper maps provided by the NH Fish and Game Department. Biologists developed the deer wintering areas through air photo interpretation and ground surveys in 1986 with periodic updates in certain towns.
- Undeveloped Shorelines were developed by buffering all perennial streams and bodies of open water larger than 10 acres at 150 and 300 feet. Through air photo interpretation and the use of several data sets (including USGS topo, NH Land Cover, and NH DOT Roads) developed areas were delineated then removed from the buffered areas. The entire 300' zone was removed for any given area if any development fell within the 150' zone. Within the 150' to 300' zone, the buffer was removed only around and outside of existing development (i.e. Between the development and 300'). Developed land was determined to be any man-made structure or surface (buildings, paved roads, etc.) or non-natural land cover (row crops, hayed fields, lawn, etc.).
- Slopes were developed from the USGS National Elevation Digital Elevation Model, provided by USGS. Steep slopes included all slopes 35% and over. South Facing Slopes included all slopes with south and southwest aspects (all azimuths between 157.5 degrees (SSE) and 246.5 degrees (WSW)).
- Open Lands were derived from the 2001 NH Landcover Assessment, classes 211 (Row Crops), 212 (Hay/Pasture), 221 (Orchards), and 790 (Other Cleared).

Wildlife Habitat

Prepared by the Society for the Protection of New Hampshire Forests
for the Mascoma Watershed Conservation Council - January 2003

MWCC Mascoma Watershed Conservation Council
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Mascoma River Watershed

New Hampshire

Key:

- Watershed Boundaries
- Contour Lines (20 meter)
- Municipal Boundaries
- Utility Lines
- Lebanon Airport
- Rail Lines

Roads

- Interstate
- Secondary Highway
- Local
- Not Maintained / Discontinued

- Conservation and Public Lands
- Streams
- Lakes and Ponds
- Wetlands (NWI)

Co-Occurrence Values

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7 - 9

Scale: 1:45,000

5000 0 5000 10000 15000 20000 25000 Feet

1 0 1 2 3 4 5 Miles

N

LYME
DORCHESTER
HANOVER
CANAAN
ORANGE
GROTON
ALEXANDRIA
LEBANON
ENFIELD
PLAINFIELD
GRANTHAM
GRAFTON
SPRINGFIELD

Reservoir Pond
Cummins Pond
Clarke Pond
Goose Pond
Canaan Street Lake
Boston Lot Lake
Mascoma Lake
Mirror Lake
Crystal Lake
Spectacle Pond
Smith Pond
George Pond
Grafton Pond
Eastman Pond
McDaniels Marsh

Data Sources:

Most of the data displayed here represents stock data sets obtained in 2001from the NH GRANIT (New Hampshire Geographically Referenced Analysis and Information Transfer System) database as maintained by the Complex Systems Research Center (CSRC) at the University of New Hampshire (UNH). NH GRANIT is a cooperative project to create, maintain, and make available a statewide geographic data base serving the information needs of state, regional, and local decision-makers. A collaborative effort between the University of New Hampshire and the NH Office of State Planning (OSP), the core GRANIT System is housed at the UNH Institute for the Study of Earth, Oceans, and Space in Durham. The GRANIT approach to a statewide GIS depends upon the cooperative efforts of a host of agencies, collaborating on various elements of database design and construction as well as application development.

NH GRANIT and CSRC maintain a continuing program to identify and correct errors in these data. CSRC, OSP, SPNHF and the cooperating agencies and organizations make no claims as to the validity or reliability or to any implied uses of these data.

Other Data Sources:

- Roads derived from NH DOT roads layer (5/2002)

-Conservation Lands data provided by GRANIT and includes additional properties and updated parcel boundaries from UVLSRPC and MWCC

Map Disclaimer:

This map is one of a series of maps that were produced as part of a watershed-wide natural resource inventory for the Mascoma Watershed Conservation Council and is intended to be used for planning purposes only. Representations of property lines on this map are one interpretation of available data and should not be construed as binding or conclusive evidence of ownership.

NATURAL RESOURCE CO-OCCURRENCE ANALYSIS

High-value natural resource areas can best be identified by creating a resource co-occurrence map. This is typically the final stage in a natural resource inventory (NRI) and it is developed by overlaying the selected resource layers in the GIS to identify locations where multiple occurrences of those resources exist. These co-occurrences are then displayed on the map with a range of colors/shades to indicate increasing value or importance. Darker shades indicate that more resources and/or higher value resources lie on a particular location. This map may be referred to as "organic" because it reflects the locations as well as the form or shape of the natural resources that are included in the co-occurrence model.

A natural resource co-occurrence model applies numeric values to selected natural resources. It is based on the conservation goals and objectives for the particular study area and it provides the framework for the numerically based co-occurrence analysis. Co-occurrence models can be very complex, utilizing many resources, with multiple point values and incorporating proximity analyses, or they may be very simple.

The co-occurrence model for the Mascoma Watershed Conservation Council consisted of fifteen natural resource factors. Each factor was assigned a value of 1 point. The resources include:

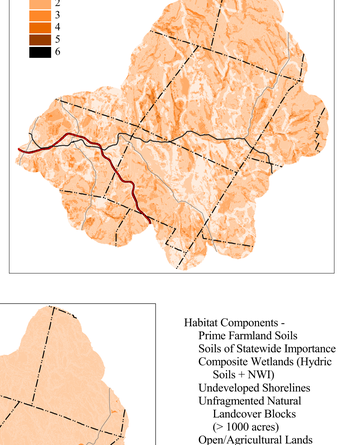
Habitat Components -
- Prime Farmland Soils
- Soils of Statewide Importance
- Composite Wetlands (NWI + Hydric Soils)
- Undeveloped Shorelines
- Unfragmented Natural Landcover Blocks (> 1000 acres)
- Open/Agricultural Lands
- Quarries and Gravel Pits
- South-facing slopes (> 10% slope)
- Steep Slopes (> 35%)
- Deer Yards

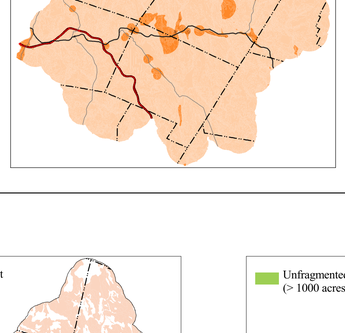
Water Resource Components -
- Stratified Drift Aquifer (max transmissivity >= 1000 sq ft/day)
- Potentially Favorable Gravel Well Areas
- Well Head Protection Areas (active sources only)
- Sanitary Radii

The main map shown here displays the total co-occurrence. Smaller inset maps below and to the right show the extents and contributions of each of the fifteen resource factors that make up the total co-occurrence.

RESOURCE CO-OCCURRENCE SUBTOTALS

A natural resource co-occurrence analysis calculates a total co-occurrence score (as is displayed in the main map). Additional analysis may then group resources into common classes or groups and calculate sub-totals associated with those groups. For example, the twelve resource factors examined in this model may be grouped into either a habitat/ natural landcover class (right) or a water resource class (below). The two inset maps below represent the co-occurrence maps for these groups.





Habitat Components -
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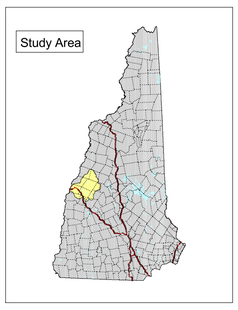

Natural Resource Co-occurrence Model

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